SOUTH DAKOTA STATEWIDE FISHERIES SURVEY
Lake Sinai, Brookings County
2102-F-21-R-48
2015

Figure 1. Lake Sinai, Brookings County

Legal Description: T109N- R52W-Sec 3-4, 8-10
Location from nearest town: 1 mile west, 1½ miles north of Sinai, SD

Surface Area: 1,719 acres
Meandered (Y/N): Yes
OHWM elevation: None set
Outlet elevation: no data
Max. depth at outlet elevation: 33 feet
Observed water level: Full
Contour map available: Yes

Watershed area: No data
Shoreline length: No data
Date set: NA
Date set: NA
Mean depth at outlet elevation: 17 feet
Lake volume: No data
Date mapped: 2002

DENR beneficial use classifications: (4) warm water permanent fish life propagation, (7) immersion recreation, (8) limited-contact recreation, (9) fish and wildlife propagation and stock watering

Introduction

General

Lake Sinai is a natural glacial lake located just northwest of the town of Sinai in west-central Brookings County. It was named by county commissioners who felt the surrounding land resembled the land around Mount Sinai in the Holy Land. Heavy precipitation in the late 1980s increased the area of the lake to its current size.

Ownership of Lake and Adjacent Lakeshore Properties

Lake Sinai is listed as meandered public water in the State of South Dakota Listing of Meandered Lakes and the South Dakota Department of Game, Fish, and Parks (GFP) manages the fishery. GFP also owns and manages a Lake Access Area on the north side of the lake. The remainder of the shoreline is privately owned.

Fishing Access

The North Lake Access Area has a double lane boat ramp, boat dock, large parking area, and public toilet. Shore fishing access around the entire lake is limited

Water Quality and Aquatic Habitat

Water clarity was excellent with a Secchi depth measurement of 2.51 meters (99 in) (Table 1). Sago pondweed, clasping-leaf pondweed and cattails were abundant.

Table 1. Water temperature, Secchi depth and observations/comments on water quality and aquatic vegetation in Lake Sinai, Brookings County, 2006-2015.

Year	*Water Temp ^{o}C (^{o}F)*	*Secchi Depth cm (in)*	*Observations/Comments (algae, aquatic vegetation, water quality, etc.)*
2015	22 (72)	251 (99)	Sago, clasping leaf pondweed, cattail
2014	18 (64)	94 (37)	Sago, cattails, bulrushes
2013	26 (79)	262 (103)	Sago, clasping leaf pondweed
2012	29 (84)	325 (128)	Sago, clasping leaf pondweed, cattail
2011	19 (67)	97 (38)	Sparse sago in bays
2010	23 (73)	91 (36)	Sago, clasping leaf pondweed
2009	26 (78)	183 (72)	Sago, some algae
2008	23 (73)	300 (118)	Algae bloom, sparse sago
2007	23 (74)	200 (79)	Sago
2006	-- (--)	300 (118)	Sago, clasping leaf pondweed

Fish Community

Lake Sinai contains a relatively diverse fish community (Table 2). Naturally-reproducing black crappies and bluegill recently have become more abundant. Smallmouth bass, first introduced in 2002, are now naturally-reproducing and very abundant and muskellunge, introduced in 2011, are established.

Table 2. Fish species commonly found in Lake Sinai, Brookings County.

Game Species	***Other Species***
Walleye	Common Carp
Yellow Perch	Black Bullhead
Northern Pike	Green Sunfish
Black Crappie	Hybrid Sunfish
Muskellunge	
Bluegill	
Smallmouth Bass	

Fish Management

Sinai Lake is actively managed for walleye, but yellow perch, black crappie, bluegill, smallmouth bass, and northern pike frequently provide additional fishing opportunity. Occasional stockings of walleye are made to maintain population abundance and fishing opportunity when natural reproduction is lacking (Table 4). Muskellunge are maintained through fingerling stocking to provide additional fishing opportunity (Table 4).

Table 3. Fish kill history for Lake Sinai, Brookings County.

Year	***Severity***	***Comments***
		No fish kills have been recorded on Lake Sinai

Table 4. Stocking history for Lake Sinai, Brookings County, 2006-2015.

Year	***Number***	***Species***	***Size***
2005	58,340	Smallmouth Bass	Fingerling
2006	173,060	Walleye	Fingerling
2010	172,480	Walleye	Fingerling
2011	1,223	Muskellunge	Lrg. Fingerling
2012	2	Muskellunge	Adult
2013	780	Muskellunge	Lrg. Fingerling
2014	1,455	Muskellunge	Lrg. Fingerling

Methods

Sinai Lake was sampled on June 29-July 1, 2015 with three overnight gill-net sets and 10 overnight trap-net sets. The gill nets were 45.7 m long x 1.8 m deep (150 ft long x 6 ft deep) with one 7.6 m (25 ft) panel each of 13, 19, 25, 32, 38 and 51-mm-bar-mesh (½, ¾, 1, 1¼, 1½, and 2 in) monofilament netting. The trap nets were constructed with 19-mm-bar-mesh (¾ in) netting, 0.9 m high x 1.5 m wide (3 ft high x 5 ft wide) frames and 18.3 m (60 ft) long leads. Sinai was also electrofished for two hours the night of September xx, 2015 to evaluate walleye recruitment.

Results and Discussion

Net Catch Results

Black bullheads were the most abundant species in the gill nets followed by yellow perch and walleye (Table 5). Black bullheads were also most abundant in the trap nets followed by black crappie (Table 7).

Table 5. Total catch from three overnight gill nets set in Lake Sinai, Brookings County, June 29-July 1, 2015.

Species	*#*	*%*	*CPUE*[1]	*80% C.I.*	*Mean CPUE**	*PSD*	*RSD-P*	*Mean Wr*
Black Bullhead	120	45.3	40.0	±9.4	4.3	8	0	--
Yellow Perch	75	28.3	25.0	±13.5	24.2	11	0	98
Walleye	55	20.8	18.3	±6.5	16.0	83	13	84
Black Crappie	7	2.6	2.3	±1.1	0.5	--	--	--
Smallmouth Bass	5	1.9	1.7	±1.5	1.4	--	--	--
Northern Pike	3	1.1	1.0	±0.7	0.4	--	--	--

*10 years (2006-2015)

Table 6. CPUE by length category for selected species sampled with gill nets in Lake Sinai, Brookings County, June 29-July 1, 2015.

Species	*Substock*	*Stock*	*S-Q*	*Q-P*	*P+*	*All sizes*	*80% C.I.*
Black Bullhead	--	40.0	37.0	3.0	--	40.0	±9.4
Yellow Perch	0.7	24.3	21.7	2.7	--	25.0	±13.5
Walleye	0.3	18.0	3.0	12.7	2.3	18.3	±6.5
Black Crappie	0.3	2.0	1.7	0.3	--	2.3	±1.1
Smallmouth Bass	--	1.7	1.0	--	0.7	1.7	±1.5
Northern Pike	--	1.0	--	0.7	0.3	1.0	±0.7

Length categories can be found in Appendix A.

Table 7. Total catch from 10 overnight trap nets set in Lake Sinai, Brookings County, June 29-July 1, 2015.

Species	*#*	*%*	*CPUE*	*80% C.I.*	*Mean CPUE**	*PSD*	*RSD-P*	*Mean Wr*
Black Bullhead	458	67.0	45.8	±15.6	9.4	13	6	--
Black Crappie	115	16.8	11.5	±3.5	3.5	20	14	105
Smallmouth Bass	33	4.8	3.3	±1.3	5.0	15	11	94
Bluegill	26	3.8	2.6	±1.6	1.6	12	8	116
Yellow Perch	18	2.6	1.8	±1.5	1.5	39	0	92
Walleye	17	2.5	1.7	±1.0	2.6	100	31	84
Yellow Bullhead	11	1.6	1.1	±0.5	0.1	100	18	--
Northern pike	3	0.4	0.3	±0.2	0.2	--	--	--
Common Carp	2	0.3	0.2	±0.2	0.7	--	--	--
Hybrid Sunfish	1	0.1	0.1	±0.1	0.0	--	--	--

*10 years (2006-2015)

[1] See Appendix A for definitions of CPUE, PSD, RSD, RSD-P and mean Wr.

Table 8. CPUE by length category for selected species sampled with trap nets in Lake Sinai, Brookings County, June 29-July 1, 2015.

Species	*Substock*	*Stock*	*S-Q*	*Q-P*	*P+*	*All sizes*	*80% C.I.*
Black Bullhead	1.4	44.4	38.6	3.2	2.6	45.8	±15.6
Black Crappie	--	11.5	9.2	0.7	1.6	11.5	±3.5
Smallmouth Bass	0.6	2.7	2.3	0.1	0.3	3.3	±1.3
Bluegill	--	2.6	2.3	0.1	0.2	2.6	±1.6
Yellow Perch	--	1.8	1.1	0.7	--	1.8	±1.5
Walleye	0.1	1.6	--	1.1	0.5	1.7	±1.0
Yellow Bullhead	--	1.1	--	0.9	0.2	1.1	±0.5
Northern pike	--	0.3	--	0.1	0.2	0.3	±0.2
Common Carp	--	0.2	--	0.1	0.1	0.2	±0.2
Hybrid Sunfish*	--	--	--	--	--	0.1	±0.1

No length categories established. Length categories can be found in Appendix A.

Table 9. Gill-net (GN) and trap-net (TN) CPUE for selected fish species sampled in Lake Sinai, Brookings County, 2006-2015.

Species	*Gear*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*
Black Bullhead	GN	0.2	0.5	--	--	--	--	0.3	0.3	1.5	40.0
	TN	2.5	1.8	0.3	0.6	--	--	0.4	2.5	40.0	45.8
Black Crappie	GN	0.2	--	--	--	--	--	0.3	--	1.8	2.3
	TN	0.9	0.2	--	0.4	0.4	0.2	11.1	2.5	8.2	11.5
Bluegill	GN	--	--	--	--	--	--	--	--	0.3	--
	TN	0.8	1.9	0.4	--	0.4	1.3	4.9	1.0	0.8	2.6
Channel Catfish	GN	--	--	--	--	--	--	--	--	--	--
	TN	--	--	--	--	--	--	0.1	--	--	--
Common Carp	GN	1.2	--	0.2	0.8	--	0.4	0.8	--	0.8	--
	TN	0.1	1.0	0.3	0.3	1.6	0.1	1.8	1.4	--	0.2
Green Sunfish	GN	--	--	--	--	--	--	0.3	--	--	--
	TN	--	0.3	0.2	0.1	0.1	--	0.1	0.1	--	--
Hybrid Sunfish	GN	--	--	--	--	--	--	--	--	--	--
	TN	--	0.1	--	--	0.1	--	--	--	--	0.1
Northern Pike	GN	0.8	--	0.2	--	0.2	--	0.5	0.8	--	1.0
	TN	--	0.3	--	0.1	--	--	0.6	0.2	--	0.3
Smallmouth Bass	GN	0.2	1.0	1.0	1.2	0.6	0.8	4.8	0.3	2.5	1.7
	TN	2.0	5.2	4.6	1.2	6.7	3.5	18.6	3.1	1.3	3.3
Walleye	GN	6.2	5.5	11.4	10.8	15.2	12.8	38.0	23.0	18.3	18.3
	TN	1.8	5.6	3.2	0.8	1.9	0.9	5.1	1.3	3.4	1.7
White Sucker	GN	--	--	--	--	--	--	--	0.2	--	--
	TN	--	--	--	--	--	--	--	--	--	--
Yellow Bullhead	GN	--	--	--	--	--	--	--	--	--	--
	TN	--	--	--	--	--	--	--	--	0.2	1.1
Yellow Perch	GN	28.0	11.0	13.6	41.8	31.8	45.4	33.8	4.5	7.3	25.0
	TN	1.8	1.5	2.0	2.2	1.0	1.5	2.7	--	0.4	1.8

Walleye

Management Objective

- Maintain a walleye population with a total gill-net CPUE of at least 15.

Management Strategy

- Stock small walleye fingerlings at the rate of 70/acre (120,330) as needed to achieve the management objective.

Walleye gill-net CPUE has exceeded the management objective since 2012 (Table 10). Size structure of the walleye population is excellent with the majority of fish measuring 43-53 cm (17-21 in) long (Figures 2, 3). Most of these fish are from the two consecutive year classes produced in 2010 and 2011 (Table 13). However, some smaller fish from the moderately-strong 2013 year class were also present (Table 13). Growth is about average for walleyes in South Dakota large lakes (Table 13).

A moderately-strong year class of walleyes was produced in 2015 (Table 12). About 71% of the stocked fingerlings (Table 11) were marked with oxytetracycline (OTC). Good quality marks were present on 21 of 47 fish examined indicating a 63% contribution of stocked fish. The size and condition of age-0 fish were at the low end of the range for Lake Sinai. Only three age-1 walleyes were sampled.

Table 10. CPUE, PSD, RSD-P, and mean Wr for all walleyes sampled with gill nets in Lake Sinai, Brookings County, 2006-2015. Stocked years are shaded.

	2006	***2007***	***2008***	***2009***	***2010***	***2011***	***2012***	***2013***	***2014***	***2015***
CPUE	6.2	5.5	11.4	10.8	15.2	12.8	38.0	23.0	18.3	18.3
PSD	46	46	12	2	28	59	7	5	92	83
RSD-P	14	15	7	0	4	0	1	0	1	13
Mean Wr	86	89	82	85	84	83	77	87	90	84

Table 11. Walleyes stocked into Lake Sinai, Brookings County, 2006-2015.

Year	***Number***	***Size***
2006	173,060	Fingerling
2010	172,480	Fingerling
2015	118,400	Fingerling

Table 12. Age-0 and age-1 walleyes sampled with nighttime electrofishing on Lake Sinai, Brookings County, 2006-2015.

Year	***Stocking***	***Age-0 CPH***	***% stocked***	***Mean length (range; mm)***	***Wr***	***Age-1 CPH***	***Mean length (range; mm)***	***Wr***
2015	fingerling	80	63	159 (138-193)	80	2	231 (212-240	86
2014	none	92		167 (149-194)	87	1	301	95
2013	none	56		194 (157-211)	86	0	267 (215-291)	85
2012	none	15		197 (177-210)	92	83	283 (231-330)	90
2011	none	262		159 (125-205)	88	65		
2010	fingerling	211	100	154 (135-199)	80	0	242 (213-275)	90
2009	none	29		185 (156-207)	96	2	249 (205-290)	81
2008	none	31		162 (135-185)	100	34	282 (251-340)	79
2007	none	113		161 (122-203)	95	17	-- --	--
2006	fingerling	291	96	175 (149-221)	85	0	251 (223-294)	81

Table 13. Weighted mean length at capture (mm) for walleyes sampled with gill nets in Lake Sinai, Brookings County, 2006-2015. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends. Sample size is in parentheses.

Year	*Age-1*	*Age-2*	*Age-3*	*Age-4*	*Age-5*	*Age-6*	*Age-7*	*Age-8*	*Age-9*	*Age-10*	*Age-11*
2015	209	340	--	469	470	--	--	541	--	--	--
(55)	(1)	(10)		(10)	(29)			(4)			
2014	260	--	408	429	--	--	472	547	--	--	--
(73)	(5)		(22)	(43)			(2)	(1)			
2013	--	294	343	455	416	424	--	--	--	--	--
(92)		(14)	(75)	(1)	(1)	(1)					
2012	195	307	420	403	449	--	--	--	--	684	--
(152)	(4)	(133)	(5)	(3)	(5)					(1)	
2011	207	352	376	429	426	--	--	--	--	--	--
(64)	(45)	(5)	(1)	(12)	(1)						
2010	280	328	366	384	--	507	--	--	530	--	--
(75)	(1)	(10)	(45)	(15)		(2)			(1)		
2009	218	283	338	369	398	--	--	--	--	--	--
(54)	(1)	(36)	(14)	(1)	(2)						
2008	208	299	--	404	--	--	573	--	--	--	655
(57)	(14)	(36)		(4)			(2)				(1)
2007	221	--	345	--	467	--	567	--	--	--	--
(22)	(10)		(5)		(6)		(1)				
2006	--	284	395	422	489	554	585	654	--	--	--
(37)		(20)	(4)	(5)	(2)	(2)	(1)	(3)			
2005	194	314	364	409	440	661	--	687	--	--	--
(35)	(14)	(6)	(6)	(5)	(2)	(1)		(1)			

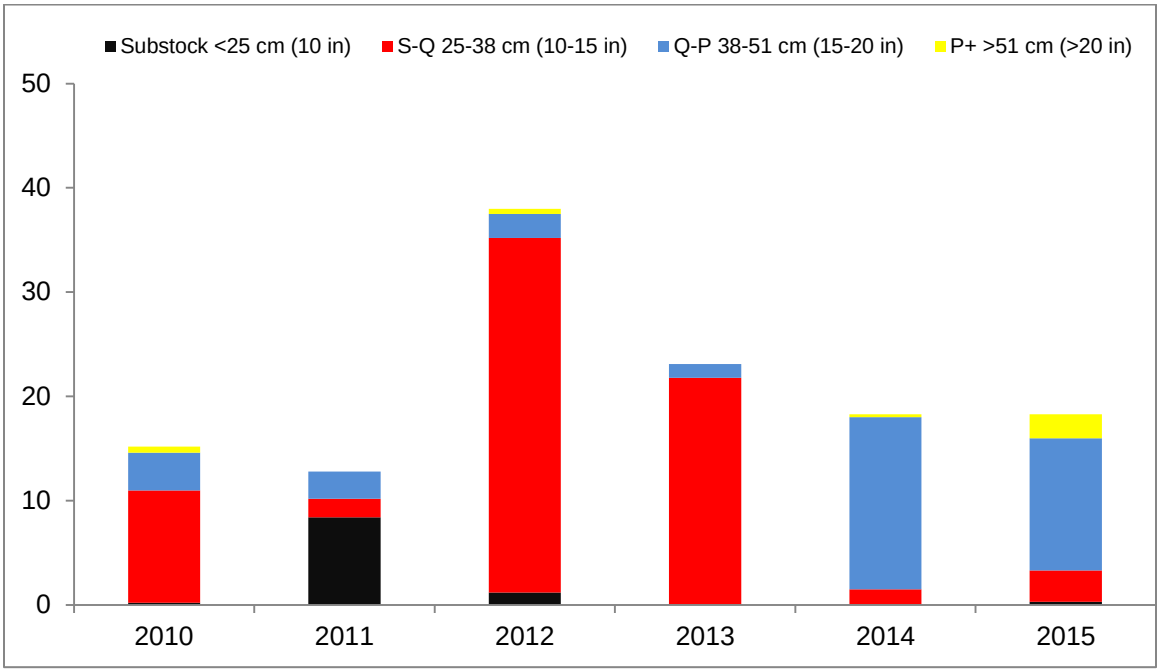

Figure 2. CPUE by length category for walleye sampled with gill nets in Lake Sinai, Brookings County, 2010-2015.

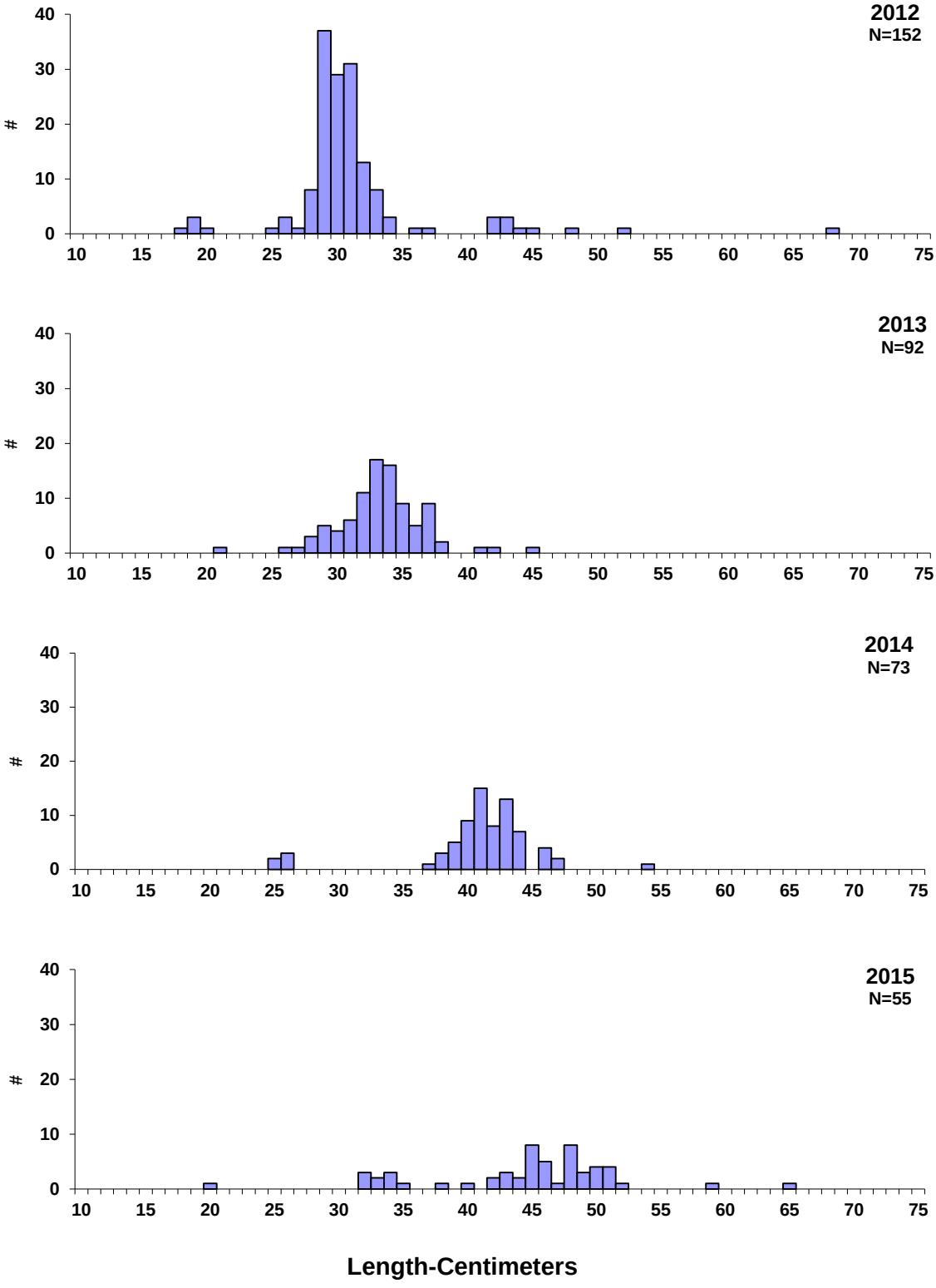

Figure 3. Length frequency histograms for walleye sampled with gill nets in Lake Sinai, Brookings County, 2012-2015.

Yellow Perch

Management Objective

- None

Management Strategy

- Monitor the yellow perch population during annual lake surveys and report the results.

Yellow perch abundance increased in 2015 after being well below average in 2013 and 2014 (Table 14). Most fish were from the 2013 year class and are growing slower than average for Lake Sinai (Table 15). No larger perch (> 25 cm or 10 in) were sampled this year (Figures 4, 5).

Table 14. CPUE, PSD, RSD-P, and mean Wr for all yellow perch sampled with gill nets in Lake Sinai, Brookings County, 2006-2015. Stocked years are shaded.

	2006	***2007***	***2008***	***2009***	***2010***	***2011***	***2012***	***2013***	***2014***	***2015***
CPUE	28.0	11.0	13.6	41.8	31.8	45.4	33.8	4.5	7.3	25.0
PSD	76	73	52	90	81	56	99	92	40	11
RSD-P	23	2	19	0	26	9	39	74	20	0
Mean Wr	98	107	101	100	101	103	96	110	105	98

Table 15. Weighted mean length at capture (mm) for yellow perch sampled with gill nets in Lake Sinai, Brookings County, 2006-2015. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends. Sample size is in parentheses.

Year	***Age-1***	***Age-2***	***Age-3***	***Age-4***	***Age-5***	***Age-6***	***Age-7***	***Age-8***	***Age-9***	***Age-10***
2015	103	179	--	--	--	--				
(75)	(2)	(73)								
2014	118	--	248	267	--	--				
(29)	(25)		(3)	(1)						
2013	--	231	260	274	322	--				
(18)		(5)	(4)	(8)	(1)					
2012	--	220	247	277	--	--				
(135)		(37)	(87)	(11)						
2011	134	199	248	268	--	--				
(227)	(9)	(186)	(23)	(9)						
2010	107	206	259	--	--	--				
(159)	(42)	(76)	(41)							
2009	--	208	251	276	--	--				
(208)		(188)	(17)	(3)						
2008	132	220	255	--	--	--				
(67)	(40)	(13)	(14)							
2007	146	221	247	--	--	--				
(44)	(12)	(29)	(3)							
2006	143	211	224	266	268	294				
(169)	(24)	(83)	(20)	(5)	(35)	(2)				
2005	128	204	225	248	287	281				
(246)	(27)	(75)	(15)	(125)	(2)	(2)				

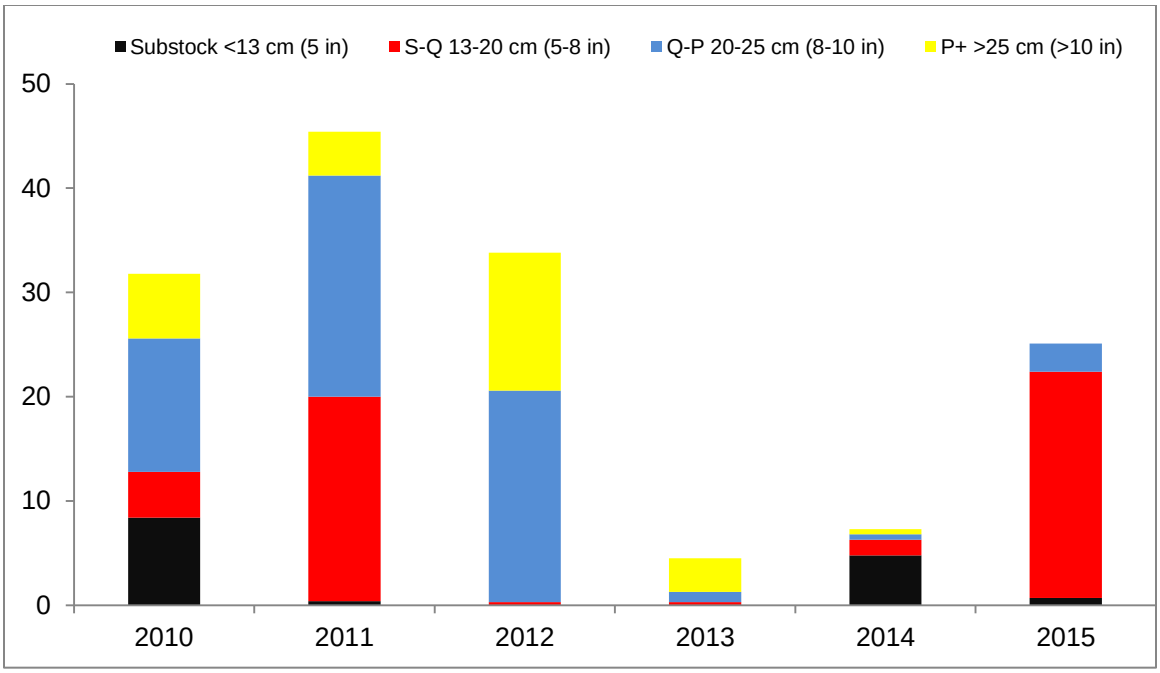

Figure 4. CPUE by length category for yellow perch sampled with gill nets in Lake Sinai, Brookings County, 2010-2015.

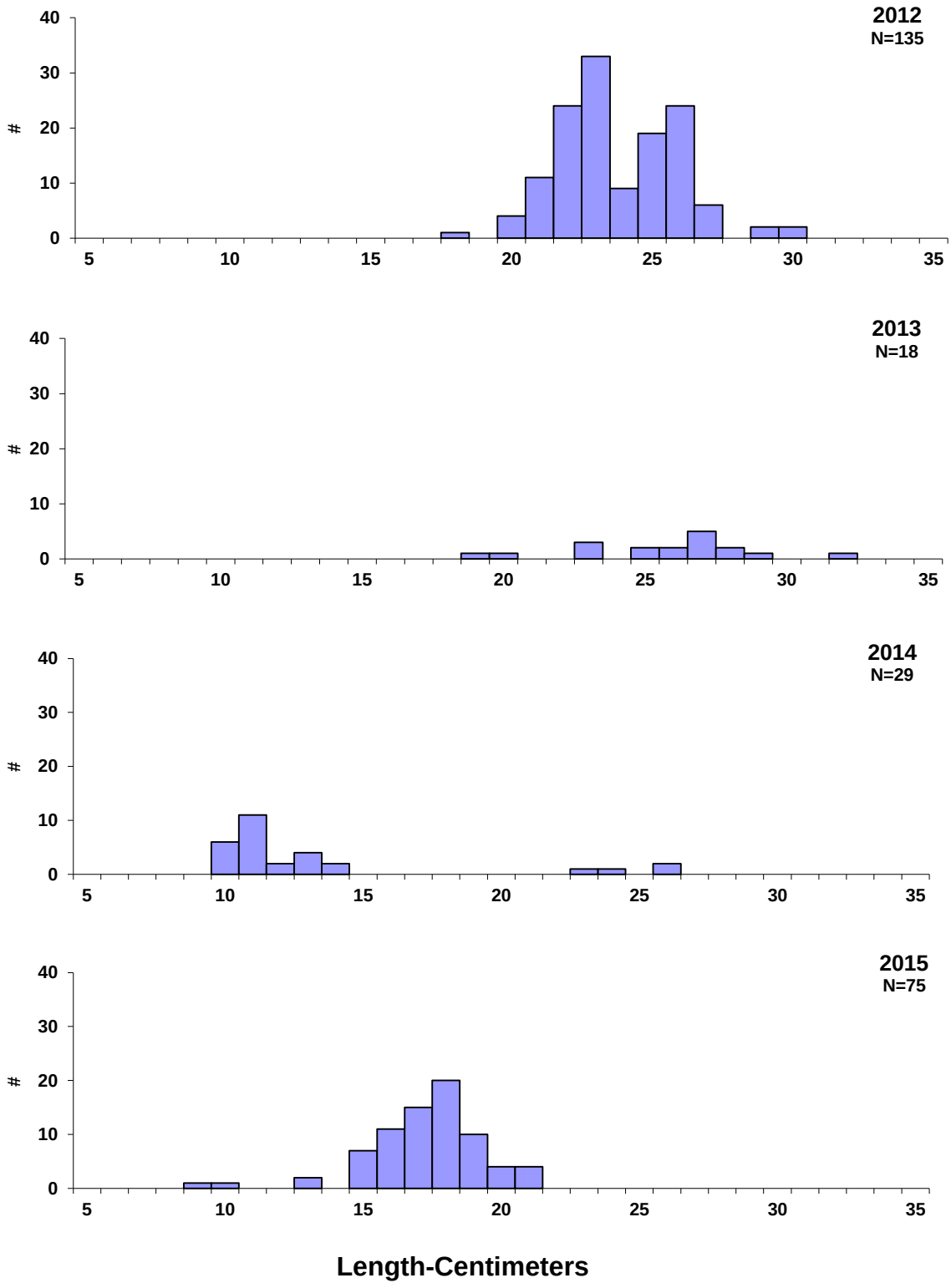

Figure 5. Length frequency histograms for yellow perch sampled in gill nets in Lake Sinai, Brookings County, 2012-2015.

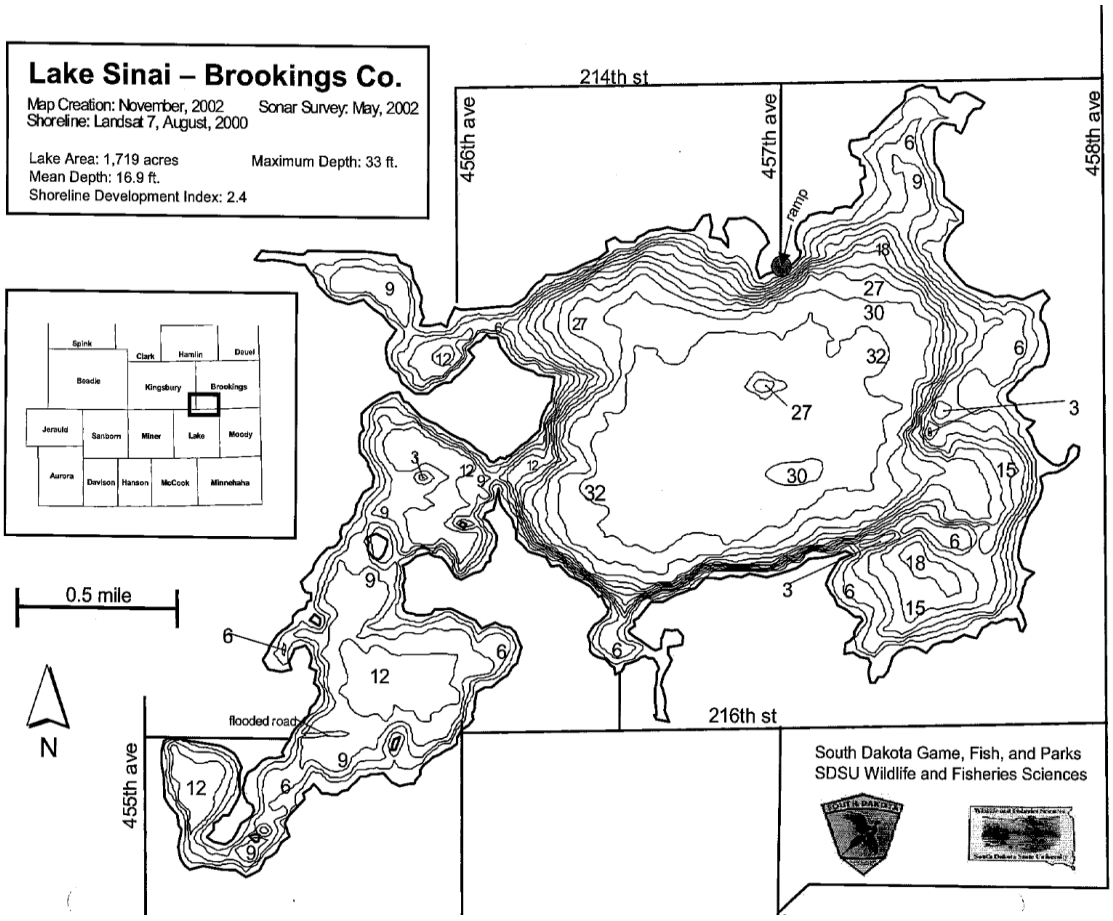

Figure 6. Contour map of Lake Sinai, Brookings County.

Appendix A. A brief explanation of catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr).

Catch per Unit Effort (CPUE) is the catch of animals in numbers or in weight taken by a defined period of effort. Can refer to trap-net nights of effort, gill net nights of effort, catch per hour of electrofishing, etc.

Proportional Stock Density (PSD) is calculated by the following formula:

$$PSD = \frac{\text{Number of fish} > \text{quality length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

Relative Stock Density (RSD-P) is calculated by the following formula:

$$RSD\text{-}P = \frac{\text{Number of fish} > \text{preferred length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

PSD and RSD-P are unitless and usually calculated to the nearest whole digit.

Size categories for selected species found in Region 3 lake surveys, in centimeters (Inches in parenthesis).

Species	Stock	Quality	Preferred	Memorable	Trophy
Walleye	25 (10)	38 (15)	51 (20)	63 (25)	76 (30)
Yellow perch	13 (5)	20 (8)	25 (10)	30 (12)	38 (15)
Black crappie	13 (5)	20 (8)	25(10)	30 (12)	38 (15)
White crappie	13 (5)	20 (8)	25(10)	30 (12)	38 (15)
Bluegill	8 (3)	15 (6)	20 (8)	25 (10)	30 (12)
Largemouth bass	20 (8)	30 (12)	38 (15)	51 (20)	63 (25)
Smallmouth bass	18 (7)	28 (11)	35(14)	43 (17)	51 (20)
Northern pike	35 (14)	53 (21)	71 (28)	86 (34)	112 (44)
Channel catfish	28 (11)	41 (16)	61 (24)	71 (28)	91 (36)
Black bullhead	15 (6)	23 (9)	30 (12)	38 (15)	46 (18)
Common carp	28 (11)	41 (16)	53 (21)	66 (26)	84 (33)
Bigmouth buffalo	28 (11)	41 (16)	53 (21)	66 (26)	84 (33)

For most fish, 30-60 or 40-70 are typical objective ranges for “balanced” populations. Values less than the objective range indicate a population dominated by small fish while values greater than the objective range indicate a population comprised mainly of large fish.

Relative weight (Wr) is a condition index that quantifies fish condition (i.e., how much does a fish weigh for its length). A Wr range of 90-100 is a typical objective for most fish species. When mean Wr values are well below 100 for a size group, problems may exist in food and feeding relationships. When mean Wr values are well above 100 for a size group, fish may not be making the best use of available prey.